

## SECTION 15055

### MOTORS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

##### 1.2 SUMMARY

- A. This Section includes basic requirements for factory-installed and field-installed electric motors.
- B. Related Sections include the following:
  - 1. All Division 3 Sections for installation of electric motors where reference to specific concrete utility pad for motor-driven equipment is made.
  - 2. All Division 15 Sections for application of electric motors where reference to specific motor requirements for motor-driven equipment is made.

##### 1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM E-548 (1994) "Standard Guide for General Criteria used for Evaluating Laboratory Competence".
- B. National Electrical Manufacturers Association (NEMA)
  - 1. NEMA MG-1 (1998)"Motors and Generators"
- C. National Fire Protection Association (NFPA)
  - 1. NFPA 70 (1998)"National Electrical Code
- D. National Electrical Testing Agency (NETA) within the American Testing Society (ATS).

##### 1.4 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

##### 1.5 SUBMITTALS

- A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
  - 1. Each installed unit's type and details.
  - 2. Nameplate legends.
  - 3. Diagrams of power and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.
- C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Qualification Data: For testing agency.
- E. Test Reports: Written reports specified in Parts 2 and 3.
- F. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations: Obtain field-installed motors of a single type through one source from a single manufacturer.
- C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to General and Supplementary Conditions section for "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.

## 1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Construction Manager at least two days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions.
  - 2. Indicate method of providing temporary utilities.
  - 3. Do not proceed with utility interruptions without Construction Manager's written permission.

## 1.8 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:
  - 1. Compatible with the following:
    - a. Magnetic controllers.
    - b. Multi-speed controllers.
    - c. Reduced-voltage controllers.
    - d. Variable frequency drives.
  - 2. Provide verification that any motor connected to a variable frequency drive has been successfully powered by the exact same drive in the past and that manufacturers of both the motor and the drive have published data verifying that their equipment operates satisfactorily in all operating modes with the corresponding component.
  - 3. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
  - 4. Matched to torque and horsepower requirements of the load.
  - 5. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases or inertia bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.

## PART 2 - PRODUCTS

### 2.1 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed and field-installed motors except as follows:
  - 1. Different ratings, performance, or characteristics for a motor are specified in another Section.
  - 2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

### 2.2 MOTOR CHARACTERISTICS

- A. Motors 1/2 HP and Larger: Three phase.
- B. Motors Smaller Than 1/4 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3,300 feet above sea level.

- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium Efficiency
- C. Stator: Copper windings, unless otherwise indicated.
  - 1. Multi-speed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.
- H. Code Letter Designations:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or G.
  - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
  - 1. Finish: gray enamel.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer and submitted for approval.
  - 1. Designed with critical vibration frequencies outside operating range of controller output.
  - 2. Temperature Rise: Matched to rating for Class B insulation.
  - 3. Insulation: Class H.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.
  - 1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
  - 1. Measure winding resistance.

2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

## 2.5 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
  1. Permanent Split capacitor.
  2. Split-phase start, capacitor run.
  3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, pre-lubricated-sleeve type for other single-phase motors.
- E. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
  1. Measure winding resistance.
  2. Read no-load current and speed at rated voltage and frequency.
  3. Measure locked rotor current at rated frequency.
  4. Perform high-potential test.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in of conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Where indicated, install motors on concrete bases complying with Division 3 requirements.

### 3.3 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  1. Run each motor with its controller in all starter and control modes of operation. Demonstrate correct rotation, alignment, and speed.
  2. Test interlocks and control features for proper operation.

3. Verify that current in each phase is within nameplate rating.

Field Quality Testing: Contractor shall engage a qualified testing agency to perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
1. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  3. Verify bearing lubrication.
  4. Verify proper motor rotation.
  5. Test Reports: Prepare a written report to record the following:
    - a. Test procedures used.
    - b. Test results that comply with requirements.
    - c. Test results that do not comply with requirements and corrective action taken to achieve compliance.

### 3.4 ADJUSTING

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

### 3.5 CLEANING

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

**END OF SECTION 15055**